

OSMUNDACEAE

紫萁科 *zi qi ke*

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Plants terrestrial, with mostly unbranched, often massive, erect, or shortly creeping, ascending, sometimes treelike trunk clothed in roots and persistent stipes, hairy at apex. Rhizome anatomy distinctive, an ectophloic siphonostele (with a pith of parenchyma in center and phloem outside of vascular cylinder only), with a ring of discrete xylem strands, these often conduplicate or twice conduplicate in cross section. Fronds 1- or 2-pinnate, catadromous, when young bearing wool-like, uniseriate hairs, these deciduous or persistent at axes, dimorphic or with fertile portions dissimilar to sterile; stipe caespitose, spirally arranged, with laterally winged stipules at bases, bearing mucilaginous hairs when young, with a single U-shaped vascular bundle; sclerenchyma strongly developed; base of lateral pinnae nearly always distinctly articulate (but only functional in some species); pinnule base sometimes also articulate, though less distinctly so; veins free, subpinnately furcate. Sporangia not assembled in sori, following veins or entirely covering strongly contracted fertile segments, sporangia large, with 128–512 spores, opening by an apical slit, annulus lateral; spores green, subglobose, trilete; gametophytes large, green, cordate, surficial. $x = 22$.

Four genera and ca. 20 species: temperate and tropical regions worldwide; two genera and eight species (one endemic) in China.

Ching Ren-chang, Fu Shu-hsia, Wang Chu-hao & Shing Gung-hsia. 1959. Osmundaceae. *In*: Ching Ren-chang, ed., *Fl. Reipubl. Popularis Sin.* 2: 77–85.

- 1a. Fronds pinnate-pinnatisect, completely dimorphic; fertile fronds at middle of plant 1. *Osmundastrum*
1b. Fronds 1- or 2-pinnate, or pinnate-pinnatisect, hemidimorphic; fertile pinnae at apical, middle, or lower part
of fertile fronds 2. *Osmunda*

1. OSMUNDASTRUM C. Presl, Gefässbündel Farn, 18. 1847.

桂皮紫萁属 *gui pi zi qi shu*

Plants terrestrial, moderate-sized to large. Rhizome erect, stout, woody, without scales. Fronds dimorphic; stipes arising as a crown at apex of rhizome, ± hairy when young, base of stipe swollen and with lateral flaplike stipules; lamina pinnate-pinnatisect, fertile portions reduced to a midrib with almost no lamina present; pinnae articulate to rachis. Sporangia large, naked, with a small patch annulus. $2n = 44$.

One species: China, N India, Japan, Korea, Russia (Far East, Siberia), Vietnam; North America.

1. *Osmundastrum cinnamomeum* (Linnaeus) C. Presl, Gefässbündel Farn, 18. 1847.

桂皮紫萁 *gui pi zi qi*

Osmunda cinnamomea Linnaeus, Sp. Pl. 2: 1066. 1753; *O. asiatica* (Fernald) Ohwi; *O. cinnamomea* subsp. *asiatica* (Fernald) Fraser-Jenkins; *O. cinnamomea* var. *asiatica* Fernald; *O. cinnamomea* var. *fokienense* Copeland; *Osmundastrum asiaticum* (Fernald) X. C. Zhang; *O. cinnamomeum* var. *asiaticum* (Fernald) Kitagawa; *O. cinnamomeum* var. *fokiense* (Copeland) Tagawa; *Struthiopteris cinnamomea* (Linnaeus) Bernhardt.

Rhizome creeping or ascending, short, bearing approximate fronds seemingly in a crown. Fronds dimorphic, young fronds densely covered with long, lax hairs, glabrescent and nearly naked when mature; stipe short, enlarged and winged at base, fleshy when young; sterile fronds pale yellowish green, pinnate-pinnatifid, ovate-lanceolate, 30–80(–100) × 15–25 cm,

soft papery, gradually narrowed toward acuminate apex; pinnae sessile, more than 20 pairs, 5–20 × 1.5–3 cm, incised ca. 2/3 toward costa, apex acuminate; ultimate lobes entire, margin with hairs often mixed with black ones, apex rounded; lateral veins forked; fertile fronds usually shorter and developing earlier than sterile fronds, 2-pinnate; pinnae sessile, 2–4 × ca. 1.5 cm, incised almost to costa; ultimate segments 2–4 mm wide, covered throughout with sporangia. $2n = 44$.

Often in dense populations in marshy places in mountainous areas; 600–2600 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Heilongjiang, Hunan, Jiangxi, Jilin, Sichuan, Taiwan, Yunnan, Zhejiang [N India, Japan, Korea, Russia (Far East, Siberia), Vietnam; North America].

Osmundastrum cinnamomeum and *Osmunda claytoniana* are very similar in general morphology, except the degree of dimorphism of the fronds. The fronds of *O. claytoniana* are hemidimorphic (vs. dimorphic), and the sterile pinnae are ca. 3 cm wide or more (vs. ca. 2 cm wide or more).

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2. OSMUNDA Linnaeus, Sp. Pl. 2: 1063. 1753.

紫萁属 *zi qi shu*

Plenasium C. Presl.

Plants terrestrial, moderate-sized to large. Rhizome erect to shortly creeping, stout, woody, without scales. Fronds dimorphic or more commonly hemidimorphic with dimorphic pinnae; stipes arising as a crown at apex of rhizome, ± hairy when young, base of stipe swollen and with lateral flaplike stipules; lamina 1- or 2-pinnate, fertile portions reduced to a midrib with almost no lamina present; pinnae articulate to rachis. Sporangia large, naked, with a small patch annulus. $2n = 44$.

About ten species, with some native hybrids; nearly worldwide in tropical and temperate regions, the greatest concentration of species in E and SE Asia; seven species including one putative hybrid species (one endemic) in China.

- 1a. Fronds 2-pinnate; pinnae not articulate to rachis (*O. subg. Osmunda*).
 2a. Fronds dimorphic or only apical portion fertile; pinnules all ± equally sized 6. *O. japonica*
 2b. Fronds hemidimorphic, lower pinnae fertile; apical pinnule of each pinna much enlarged 7. *O. mildei*
 1b. Fronds simple pinnate or pinnate-pinnatifid; pinnae articulate to rachis or not.
 3a. Fronds hemidimorphic; pinnae pinnate-pinnatifid, not articulate (*O. subg. Claytosmunda* Yatabe, Murakami & Iwatsuki) 1. *O. claytoniana*
 3b. Fronds simple pinnate; pinnae entire, undulate, serrate, or roughly dentate (*O. subg. Plenasium* (C. Presl) C. Presl).
 4a. Margin of pinnae roughly dentate 2. *O. banksiifolia*
 4b. Margin of pinnae entire or serrate.
 5a. Fertile pinnae basal 5. *O. vachellii*
 5b. Fertile pinnae medial, or above middle.
 6a. Margin of pinnae distinctly serrate; pinnae less than 1 cm wide 3. *O. angustifolia*
 6b. Margin of pinnae entire, undulate, or minutely serrate; pinnae 1–2.5 cm wide 4. *O. javanica*

1. *Osmunda claytoniana* Linnaeus, Sp. Pl. 2: 1066. 1753.

绒紫萁 *rong zi qi*

Osmunda claytoniana subsp. *pilosa* (Wallich ex Greville & Hooker) Fraser-Jenkins; *O. claytoniana* var. *pilosa* (Wallich ex Greville & Hooker) Ching; *O. claytoniana* subsp. *vestita* (Wallich ex Milde) Á. Löve & D. Löve; *O. claytoniana* var. *vestita* Wallich ex Milde; *O. pilosa* Wallich ex Greville & Hooker; *Osmundastrum claytonianum* (Linnaeus) Tagawa; *O. claytonianum* subsp. *pilosum* (Wallich ex Greville & Hooker) Tzvelev; *O. claytonianum* var. *pilosum* (Wallich ex Greville & Hooker) W. M. Chu & S. G. Lu.

Rhizome ascending, short, bearing several approximate fronds. Fronds hemidimorphic; stipe greenish, shorter than lamina, 15–20 cm, usually woolly; lamina pinnate-pinnatifid, narrowly oblanceolate, 30–40 × 15–25 cm, apex acute to acuminate; pinnae 20–30 pairs, fertile pinnae few, in lower middle portion of lamina; sterile pinnae linear-lanceolate, larger ones often more than 25 × 3.5 cm, incised more than 2/3 toward costa, apex acuminate; ultimate segments entire, naked at margin, or with grayish white to grayish brown hairs when young, apex rounded; fertile pinnae ca. 1/3 length of sterile ones, ca. 5 mm wide but usually with reduced lobes, covered throughout with sporangia, turning blackish brown after spores are shed. $2n = 44$.

Forming large populations on hillsides; 1600–3400 m. Chongqing, Guizhou, Hubei, Hunan, Liaoning, Sichuan, Taiwan, Xizang, Yunnan [Bhutan, N India, Japan, Korea, Nepal, Russia (Far East); North America].

2. *Osmunda banksiifolia* (C. Presl) Kuhn, Ann. Mus. Bot. Lugduno-Batavi 4: 299. 1869.

粗齿紫萁 *cu chi zi qi*

Nephrodium banksiifolium C. Presl, Reliq. Haenk. 1: 34. 1825; *Plenasium banksiifolium* (C. Presl) C. Presl.

Rhizome ascending or erect, massive, naked. Fronds simple pinnate, up to 100–180 × 30–60 cm, hemidimorphic with 3–5 pairs of fertile pinnae in lower middle portion of lamina; pinnae 15–30 pairs, subopposite or alternate, ca. 3 cm apart; sterile pinnae linear, 15–35 × 1–2 cm, lower ones shortly stalked, articulate to rachis, leathery, glabrous, margin thickened, roughly dentate; lateral veins pinnate, lower veinlets forked; fertile fronds developing several times per year; fertile pinnae ca. 1/2 length of sterile ones, 2–4 mm wide, covered throughout with sporangia and turning brownish after spores are shed. $2n = 44$.

By streams in valleys; 300–800 m. Fujian, Guangdong, Jiangxi, Taiwan, Zhejiang [Indonesia (Java), Japan (including Ryukyu Islands), New Guinea, Philippines].

3. *Osmunda angustifolia* Ching, Acta Phytotax. Sin. 8: 160. 1959.

狭叶紫萁 *xia ye zi qi*

Rhizome erect, woody. Fronds simple pinnate, up to 60 × 15 cm or larger; pinnae 12–18 pairs; sterile pinnae linear-lanceolate, up to 10 × 1 cm, shortly stalked, articulate to rachis, margin distinctly coarsely serrate; veins free, branched several times with one group to each serration; middle pinnae fertile, or sometimes extending to apical ones; fertile pinnae reduced almost to a midrib and bearing sporangia in distinct groups.

By streams on hillsides; 300–800 m. Guangdong, Hainan, Hunan, ?Taiwan [Thailand].

Osmunda angustifolia is much less common than the closely related *O. vachellii*, differing from the latter by the distinctly toothed pinna margins. It also differs from the similar species *O. banksiifolia* by not having fertile pinnae at the base of the fronds.

4. *Osmunda javanica* Blume, Enum. Pl. Javae 2: 252. 1828.

宽叶紫萁 kuan ye zi qi

Plenasium javanicum (Blume) C. Presl.

Rhizome massive. Fronds to 2 m, monomorphic with pinnae dimorphic; stipe shiny, pale brown, up to 60 cm, up to 1.5 cm in diam. at base, stiff; lamina shiny, pale green, broadly oblong, up to 80 × 50 cm, leathery, glabrous, pinnate; pinnae 25–30 pairs, lower pairs opposite, up to 22 × 2–2.5 cm; upper ones alternate, ascending, 4–5 cm apart, lanceolate, margin entire, undulate, or minutely serrate; veins thick, 2 or 3 times furcate; a few middle or below-middle pairs of pinnae fertile, linear, 5–12 × ca. 1 cm, sometimes basal ones sterile and wider.

Tropical evergreen forests; 600–1600 m. Guangxi, Guizhou, Hainan, Yunnan [S India, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

5. *Osmunda vachellii* Hooker, Icon. Pl. 1: t. 15. 1836.

华南紫萁 hua nan zi qi

Rhizome erect, stout, woody. Fronds simple pinnate, with numerous rather distant pinnae, up to 1 m × 20–30 cm; pinnae 15–20 pairs, subopposite, ascending, ca. 2 cm apart; sterile pinnae linear-lanceolate, up to ca. 20 × 1–17 cm, base narrowly cuneate, shortly stalked, articulate to rachis, margin entire or slightly undulate, apex acuminate; veins free, 1 or 2 times branched; basal pinnae fertile, reduced to midrib with small lobes bearing sporangia, rarely with a few reduced sterile pinnae below fertile ones.

Hillsides, often by streams, sometimes in open sites, locally common; 100–1000 m. Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang [India, Myanmar, Thailand, Vietnam].

Osmunda vachellii is very attractive and appears like a *Cycas*. It can be confused with *O. javanica*, a similar fern common in countries further south. The latter has rather wider pinnae, up to 2–3 cm, with the base more broadly cuneate to rounded; also, the fertile pinnae are commonly near the middle of the fronds.

6. *Osmunda japonica* Thunberg, Nova Acta Regiae Soc. Sci. Upsal. 3: 209. 1780.

紫萁 zi qi

Osmunda bififormis (Bentham) Makino; *O. japonica* var. *sublancea* (Christ) Nakai; *O. nipponica* Makino; *O. regalis* Linnaeus var. *bififormis* Bentham; *O. regalis* subsp. *japonica*

(Thunberg) Á. Löve & D. Löve; *O. regalis* var. *japonica* (Thunberg) Milde; *O. regalis* var. *sublancea* Christ; *Osmundastrum japonicum* (Thunberg) C. Presl.

Rhizome erect, ascending, or shortly creeping. Fronds 2-pinnate, dimorphic, or rarely hemidimorphic, up to 150 × 50 cm; fiddleheads enveloped by pale reddish brown, long lax hairs, but glabrescent and naked in mature fronds; stipe green or straw-colored, terete, glabrous or glandular hairy when very young; sterile fronds oblong-subdeltoid, 30–50 × 25–40 cm, 2-pinnate; lowest pinnae largest, 20–30 cm; pinnules spreading, oblong-lanceolate to lanceolate, 5–10 × 1–2.5 cm, papery, base truncate to subtruncate, asymmetrical, sessile, margin minutely dentate, apex acute; veins all free, lateral veins joining main veins at ca. 50° angle; fertile fronds 2-pinnate; pinnules linear, 2–4 mm wide, covered throughout with sporangia except on costae, falling soon after spore dispersal. $2n = 44$.

Forests, by streams, exposed hillsides, grasslands; 100–3000 m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, N India, Japan (including Ryukyu Islands), Kashmir, Korea, Myanmar, Pakistan, Russia (Sakhalin), Thailand, Vietnam].

Putative Hybrid

7. *Osmunda mildei* C. Christensen, Index Filic. 474. 1906.

粤紫萁 yue zi qi

Osmunda bipinnata Hooker (1857), not Linnaeus (1753).

Rhizome erect, woody. Fronds 2-pinnate, up to 1 m × 30 cm; stipe shiny, 25–30 cm, slender; lamina ovate-oblong, 30–45 × ca. 20 cm; pinnae 7–11 pairs, subopposite, ascending, ca. 4 cm apart, shortly stalked, sessile upward, oblong-lanceolate, 10–15 × ca. 4 cm, apex caudate, imparipinnate; pinnules 10–12 pairs, approximate, ovate or oblong, 1.5–2 × 0.8–1.2 cm, base obtuse, sessile, upper pinnule base connate; apical pinnae oblong, simple, sterile; middle pinnae pinnate with a large apical pinnule up to 4–5 cm and numerous smaller, oblong lateral pinnules; basal 4–7 pairs of pinnae like middle ones but shorter and often fertile, 4–5 × ca. 1 cm; fertile pinnules linear, 5–7 mm. Sporangia on margin of reduced basal pinnule.

● Locally rare, on hillsides in forests; 400–500 m. Guangdong, S Jiangxi.

Osmunda mildei was first described from Hong Kong and appeared to be extinct for almost a century. Recently, small populations in Shenzhen and S Jiangxi were discovered. It appears to be a native hybrid between *O. japonica* and *O. vachellii* or *O. angustifolia*. It differs from *O. japonica* by the terminal pinnule of each pinna elongated and much larger than the lateral ones on the same pinna.